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In re Application of:	:	
Steven L. Edwards et al.	:	Examiner: Jose A. Fortuna
U.S. Serial No. 10/679,862	:	Group Art Unit: 1731
Filed October 6, 2003	:	
Docket No. 12389 (GP-02-12)	:	
For: FABRIC CREPE PROCESS FOR MAKING ABSORBENT SHEET	:	

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Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

DECLARATION OF STEVEN L. EDWARDS UNDER 37 CFR §1.132

Sir:

Steven L. Edwards, being familiar with the subject matter of the above-noted patent application hereby declares:

1. I was awarded a Ph.D. degree from The Institute of Paper Chemistry in 1976 and have worked in connection with paper manufacture and paper product development on many projects involving forming and drying paper since that time. In particular, I have extensive experience with the manufacture of absorbent sheet and associated products.

2. I have read the *Official Action* of November 15, 2006 relating to United States Serial No. 10/679,862 and understand that Claims 1-48 and 123-150 have been rejected over prior art as unpatentable. Specifically, Claims 1-48, 123-131 and

143-150 have been rejected as anticipated by (i.e., fully described by), or in the alternative, as obvious over *Klowak*, United States Patent No. 4,849,054 or *Grinnell et al.*, United States Patent No. 5,314,584; while Claims 132-142 were rejected as obvious over these references. I have been asked by Counsel to comment on *Klowak '054* and *Grinnell et al.* '584 as well as comment on the invention claimed in the above-identified United States Patent Application Serial No. 10/679,862 (sometimes referred to hereafter as the "'862 Invention") as compared with the cited references and as compared with conventional papermaking art generally.

3. The '862 Invention is generally directed to a wet-press process for making absorbent sheet including compactively dewatering, that is, wet-pressing a nascent web and subsequently belt or fabric-creping a wet web from a transfer surface such that the wet web is ***re-distributed*** on the creping belt, for example, into interconnected high local basis weight regions and low local basis weight regions. What is very unique about the '862 Invention is that fiber is re-distributed (after forming the web) on the fabric creping surface such that fiber changes its position and orientation in the web. This post-formation rearrangement or redistribution of the fiber in the web is very different from conventional practice in the papermaking industry. Consider, for example, the attached pages from the Handbook of Pulp and Paper Technology, Britt, K.W., 2nd ed. Ch. 6, pp. 401-418 (Exhibit 1); especially page 401, second full paragraph which states that web formation determines fiber position and direction:

> ***As the position and direction of the fibers in the sheet structure is almost entirely determined by the forming process***, it follows that many of the most important quality characteristics of the paper are established here. Properties mainly determined by the forming section are: formation, strength isotropy, fines distribution throughout the sheet, wire mark, and to a large extent, surface uniformity.

Changes in the web structure after formation are conventionally avoided because such changes produce defects such as strength defects, surface defects "orange peel" and so forth. It is surprising that the fiber in an already formed web can be re-distributed to form absorbent sheet with desirable properties such as increased bulk, reduced, yet uniform tensiles, increased CD stretch and so forth as is seen in United States Patent Application Serial No. 10/679,862. I will comment on the invention in more detail below after commenting briefly on *Klowak '054* and in some detail as to *Grinnell et al.* '584 which relates to paperboard manufacture.

4. Regarding *Klowak* '054, the Examiner noted in the November 15, 2006 *Office Action* that the text at Col. 8, lines 8-25 and **Figures 3** and **4** *Klowak* appeared to describe high and low local basis weight regions:

> An increase in speed differential only from the base line conditions makes it easier for the vacuum to pull the web deeper into the fabric voids such that increases in bulk are attained at the existing relatively low level of vacuum. The limiting factor regarding stretch is alleviated. Upon further increases in speed differential, the web is forced into being shortened or contracted by ramming it into the cross machine filaments of the fabric, in particular, by virtue of the web's higher velocity relative to the velocity of the fabric. The extra lengths of the web in the case of contraction are visualized as being "stuffed"into the voids of the fabric to some extent. The limitation in this case lies in the amount of extra web length that the fabric can accommodate in such a manner under the existing level of vacuum. At still a higher speed differentials, the web has been observed to partially fold over on itself when apparently the capacity for such accommodation was exceeded.

I believe that text and the photographs of *Klowak* '054 is consistent with conventional creping where the web is not re-distributed on the creping belt, but where the web is shortened, folded and the bulk increased.

5. In my opinion *Klowak* '054 does not disclose, teach or suggest products with local basis weight variation; the text states that the web is transferred to the fabric via suction and the **Figures** are consistent with conventional crepe-bar and embossed geometry of webs which do not have local variation in basis weight. Local variation in basis weight is difficult to observe visually, even microscopically, at basis weights of 5-30 lbs/ream (*Klowak* notes this basis weight range at Col. 3, lines 24-25.), and I see no evidence in the *Klowak* '054 reference that local variation in basis weight was, in fact, achieved. I do not believe the photographs of *Klowak* show any redistribution or rearrangement of fiber in the web. In

general, techniques involving light penetration cannot be used to distinguish more dense regions which may be more opaque from less dense regions of the same local basis weight. Also, glassine, relatively transparent regions, cannot be differentiated from other regions of the same (or lower) local basis weight by light penetration. In order to measure local basis weight variation in paper, X-ray analysis can be used for paperboard. For tissue and towel, we have successfully employed a beta-particle absorption technique; discussed in more detail in paragraph 23 of this *Declaration.*

6. In addition, it is clear that *Klowak* '054 does not contemplate creping under pressure (which conventionally might be considered to densify the sheet and make it less absorbent); but rather *Klowak* '054 notes at numerous points that fabric creping must be non-compressive. *See Klowak* '054, Col. 5, lines 26-39:

> The gap in the non-compression nip 36 is so set that the surface of material **40** barely contacts the exposed surface of web **24**. The surface speed of transfer roll **34**, and, therefore, the speed of web **24** at nip **36** must be greater than the predetermined speed of material **40**. Preferably speed **V1** of roll **34** is about 10% to about 40% greater than the speed **V2** of material **40**.
>
> In an alternative embodiment, transfer roll **34** may be eliminated. In this arrangement, compression means for removing water may be provided by a nip between a press roll and back-up roll for felt **26** and downstream of the nip a non-compression nip may be formed between a felt-supporting roll and material **40**.

as well as Col. 7, lines 29-34:

> The roll carries the web to a non-compression nip defined between the roll and the embossing fabric. At the non-compression nip, the web is directly transferred to the embossing fabric by application of the vacuum through the fluid-pervious fabric.

It is further noted that *Klowak* '054 describes absorbent sheet with CD stretch values of less than 4% (most less than 3%). *See* Table I at Col. 9-10 of *Klowak* '054. The elevated CD stretch values for wet-pressed absorbent sheet seen with the '862 Invention are unexpectedly superior over *Klowak* '054. Reviewing the reference as a whole, I do not believe that *Klowak* suggests a process that redistributes fiber of a formed web on a creping fabric.

7. Before discussing the *Grinnell et al.* '584 patent in more detail, I think it is noteworthy that the '584 *Grinnell et al.* patent includes Bernard Klowak as a co-inventor, the same Bernard Klowak of the '054 *Klowak* patent cited in making the rejections. Both worked for James River Corporation or one of its predecessors.[1] The two references are directed to making very different products and I believe the inventors recognized that the products and processes involved are fundamentally different, which is why the later *Grinnell et al.* patent was filed. The references also say to make the products differently, i.e., *Klowak* '054 directed to use a non-compressive fabric creping nip, while *Grinnell et al.* '584 says to crepe under pressure. In my opinion, one of skill in the art would not look to the *Grinnell et al.* '584 patent for guidance as to producing absorbent sheet. I reach this conclusion because *Grinnell et al.* '584, considered as a whole, is not something one of skill in the art would look to for guidance in making absorbent sheet. The products are much too dense, the basis weights much too high, the fabrics much too coarse and so forth.

8. United States Patent No. 5,314,584 to *Grinnell et al.*, relates to paper cover stock material with a textured surface pattern suitable for book covers or wallpaper. This patent does not describe material suitable for absorbent sheet as is claimed, for example, in Claims 25 and 29 of the '862 application which specifically recite an absorbency of at least 5 g/g. *Grinnell et al.* '584 teaches a sheet with an apparent density (sic)[2] of greater than 4 lbs per 3000 ft^2 ream per mil of caliper (see Claim 1 of the '584 patent) or, in other units, a specific volume of less than about 4 cc/g. Furthermore, I do not believe the *Grinnell et al.* '584 reference relates to absorbent sheet at all as that terminology is used in the paper industry. Rather, one of skill in the art would consider *Grinnell et al.* '584 as relating to "flat" paper. In this regard, I am attaching as Exhibit 2 copies of pages 2, 3 and

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[1] James River Corporation was ultimately acquired by Georgia-Pacific Corporation, which also owns this '862 application

[2] This is perhaps more accurately referred to as specific basis weight

179 of The Dictionary of Paper, American Paper Institute (1980) which describes absorbent papers as follows:

> **Absorbent Papers.** Soft, loosely felted papers that readily absorb water solutions or liquid chemicals. They are not sized with water-repellent agents, but may be treated with materials that enhance their wet strength. They include blotting, filter, matrix, and toweling papers, and base papers for the manufacture of vegetable parchment, artificial leather, vulcanized fiber, and many other processed papers.

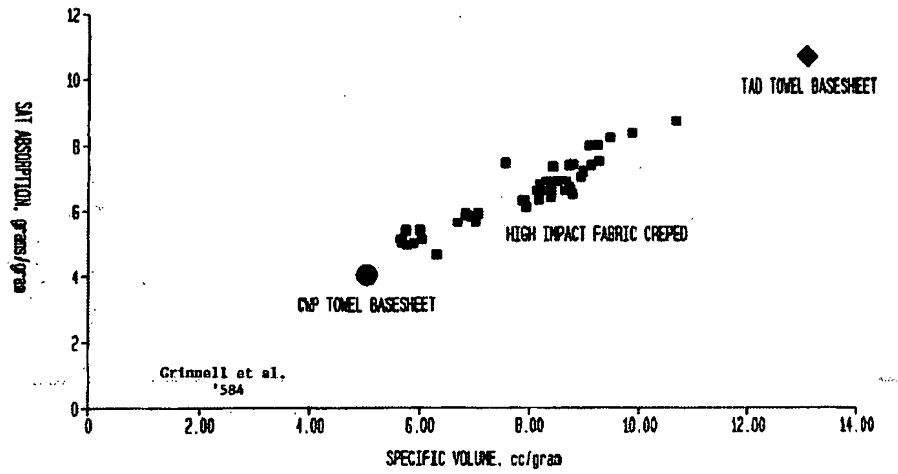
while "flat" papers are described as follows:

> **Flat Paper.** Paper which comes from the mill in flat sheets, without fold or crease. The term is applied especially to writing papers in packages of flat sheets of standard sizes and finishes.

So called "flat" papers include paperboard used as cover stock, linerboard for corrugated products as well as packaging papers. Flat papers are formed differently from absorbent sheet. They are not very absorbent and not useable in tissue and towel products, for example and are often sized in a size press as described in the *Grinnell et al.* '584 patent. Sometimes "flat" paper is simply referred to as "paper", while absorbent papers are referred to as "tissue", "towel" or with like terminology to distinguish it from flat paper. One of skill in the art would not consider the products or manufacture thereof similar or interchangeable, as is further discussed herein.

9. There is provided on **Figure 24** of United Patents Patent Application No. 10/679,862 (below) the approximate location of the sheet described in *Grinnell et al.* '584 in terms of specific volume. It is seen that the sheet of *Grinnell et al.* '584 likely has very low absorbencies, probably less than about 2 g/g SAT values. It is also seen in **Figure 24** that the sheet of the '862 Invention has high absorbency and bulk, including specific volumes of more than 10 cc/g and absorbencies of more than 8 g/g.

FIG. 24



10. One of skill in the art would recognize the '584 patent as relating to paperboard, a flat paper which has entirely different properties than absorbent cellulosic sheet. Before discussing *Grinnell et al.* further, it might be useful to present more general information here before specifically discussing the board properties disclosed in the '584 patent. Consider the following definitions available from the American Forest and Paper Association[3]:

> **Paperboard:** One of the two subdivisions of paper. The distinction is not great, but paperboard is heavier in basis weight, thicker, and more rigid than paper. All sheets 12 points (0.012 inch) or more in thickness are classified as paperboard. There are exceptions. For example, blotting papers, felts, and drawing paper in excess of 12 points are classified as paper, while corrugating medium, chipboard, and linerboard less than 12 points are classified as paperboard.

The same set of definitions describes tissue (absorbent sheet) quite differently:

> **Tissue:** A general term indicating a class of papers which are characteristically gauzy in texture and, in some cases, fairly transparent. They may be glazed, unglazed, or creped, and are used for a variety of purposes. Examples of different types of tissue papers include sanitary grades such as toilet, facial, napkin, towels, wipes, and special sanitary

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[3] www.afandpa.org/Content/NavigationMenu/Pulp_and_Paper/Glossary/Glossary.htm

> papers. Desirable characteristics in these types of tissue papers are softness, strength, and freedom from lint. Other examples of tissue papers are decorative and laminated tissue papers and crepe papers, often used in gift wrapping and to decorate. Desirable characteristics here are appearance, strength, and durability. Tissue papers are divided into three major categories: At-Home (or Consumer), Away-from-Home (or Commercial & Industrial), and Specialty.

11. Further distinctions between absorbent sheet and paperboard and the like are appreciated from Britt, K.W. ed., Handbook of Pulp and Paper Technology, Ch. 6, Exhibit 1, to this *Declaration.* It is noted in the Handbook that products such as paperboard, liner, wrapping material and the like which are much denser than tissue and towel and are formed differently from absorbent sheet preferably using different equipment. The differences between the products is largely due to furnish selection and formation of the web, which I think further demonstrates the unexpected nature of the '862 Invention. Consider:

Page 401, Col. 1, third full paragraph:

> Due to the wide variation in paper properties (tissue, greaseproof, boards, etc.), basis weights (3 to 3000 lb), and speeds (10 to 5000 fpm) used in the industry, the demands on the forming section varies greatly. This has resulted in the development of a number of different types of forming methods, each with its preferred application.

First full paragraph, Col. 2, p. 403:

> The time needed to form a sheet increases at least with the square of the basis weight and is proportional to the drainage constant of the pulp. (Figs. 3 and 4.) The drainage constant can increase more than a thousand times, due to beating of the pulp and increases also with retention of fine material. This together with the very large variation in basis weights being produced illustrates why some products such as tissue can be made at very high speeds (5000 fpm), despite a very short forming length, while products like building board are made at speeds of 30 fpm. The large variation in drainage times needed has produced different types of drainage processes for different products.

Page 405, Col. 2, second full paragraph:

> The fourdrinier wire section is still the most flexible of all forming methods, both as regards types or paper manufactured and its ability to control of paper quality. Open wire formers are used for the heaviest types of boards, made at very slow speeds, as well as for reasonably light sheets made at speeds up to 3000 fpm. It has by far the largest drainage capacity of all formers used today. The open wire former is limited in speed, due to the open surface, and will most likely never be used for speeds in excess of 4000 fpm. Products demanding higher drainage capacity than can easily be built into an open wire former are produced on multiple forming devices.

Note that heavy grades of paper are compacted when formed; *see* the Handbook at p. 412, 4th full paragraph of the second column:

> Some heavy grades of paper and pulp that are difficult to drain need a high vacuum over a substantial length to accomplish the compaction and suction of air through the sheet. To accomplish this with ordinary suction boxes creates too much friction, thus forcing the development of rotary suction boxes and rotabelts....

Contrast the foregoing with the first full paragraph to the 3rd full paragraph of p. 413. Col. 1 of the Handbook:

> On very light easy draining papers (like tissue) that are always run with pick-up arrangements, suction couches are not required. Here the couch is normally a grooved roll that makes it possible to perform the pick-up against the roll without crushing.

Page 415, first full paragraph, Col. 1:

> **Suction Breast Roll Formers** Very special forming devices have been developed for high-speed manufacture of lightweight sheets, especially tissue and toweling. The suction breast roll former shown in Fig. 20 page 418 is typical for such an arrangement. The former consists of an open grill roll normally with a two-compartment suction box provided either with a wire sleeve or a wire wrapping part of its periphery and a stationary lip extending from the headbox over the forming area that defines the forming zone. The forming length is very short which limits the usefulness of this former to lightweight sheets. The curvature of the upper lip must conform to the drainage curve of the sheet being formed, making the former most suitable as a single purpose machine. The high shear against the stationary top lip also limits the basis weights and the top speeds for which it can be used. It is today the dominant former for tissue

> papers and is used at speeds up to 4000 fpm. However, there are indications that a new approach is needed for speeds above 4000 fpm. Two recent developments in suction roll formers are those of Scott, described in *Paper Trade J.*, 152, No. 53. 22. (Dec. 30, 1958), and of Kimberly-Clark, *Paper Trade J.*, 163, No. 6, 40, (Feb. 10, 1969). The Scott forming section is shown in Fig. 15.

Page 415, paragraph spanning Col. 1 and Col. 2:

> Forming between two surfaces is very different than forming on an open table. Sufficient pressure must be exerted in the forming zone to drain the sheet. This pressure also causes lateral movement of the furnish out of the forming zone, limiting the time and pressure that can be applied in such a former. The drainage capacity of a twin wire former is, therefore, much lower than for an open wire former, limiting its usefulness to papers like newsprint, corrugating medium, bag, and medium weight fine papers. Due to the lower drainage capacity these papers are made at consistencies that are higher than for open wire formers. To achieve good formation at these consistencies, headboxes with high shear are necessary and are being developed. Twin wire formers have, from necessity, very much shorter forming areas.

From the above, I believe it is clear that low weight, porous products have an fundamentally different structure than flat paper or paperboard. This difference can also be discerned from porosity measurements, discussed below.

12. Porosity is another feature which is used to characterize paper products. Consider the following[4]:

> **Porosity**. The porosity is an indication of the openness of paper, as measured by resistance to the passage of air through the sheet.
>
> Two types of instruments are generally used to measure porosity - Gurley and Sheffield. The Gurley Instrument measures the seconds required for given volume of air to pass through a single sheet of and is generally used for porous papers. A high reading indicates a less porous (or more dense) paper. Sheffield porosity measures the flow rate of air through a single sheet and is generally used for non-porous or dense sheet. A high Sheffield reading indicates a more open paper. A typical Gurley porosity test for 50 lb. smooth offset would be 10-20 seconds. Sheffield readings of 60 lb. coated paper would be 10-20 units of air flow.

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[4] www.gouldpaper.com/public/special/guides/GLD/GOULDWEB/TESTING.HTML

13. Gurley porosity is typically used to characterize heavy Kraft paper, packaging materials, paperboard and the like rather than absorbent sheet. Some typical Gurley porosity values for such material appears below.

Grade	Description	lb/ream Basis Wt	sec/100cc Gurley
Surgical Kraft Paper	Bleached white kraft, highly breathable.	42 - 45	10 - 35
Corrugated Cardboard.	B-Flute, 3 mm		80
SPK®	Sack Kraft, Multiwall	43 - 100	15
SPX®	Hith performance extensible sheet	43 - 75	15
SPX® Velocity	High perf. Ext. sheet with exceptional air perm.	50 - 60	5
SPX® Vector	Superior strength and high air perm.	75 - 80	10

This test is not ordinarily used for absorbent sheet; however we have a Gurley device in our Neenah, WI research facility and tested a paper towel for purposes of comparison. A two-ply, embossed Brawny® towel scored 0.43 seconds. The paperboard in *Grinnell et al.* '584 appears to have scored over 6 1/2 seconds in all cases in the Gurley porosity test, indicating to me that all of the products contemplated by the *Grinnell et al.* '584 reference are paperboard.

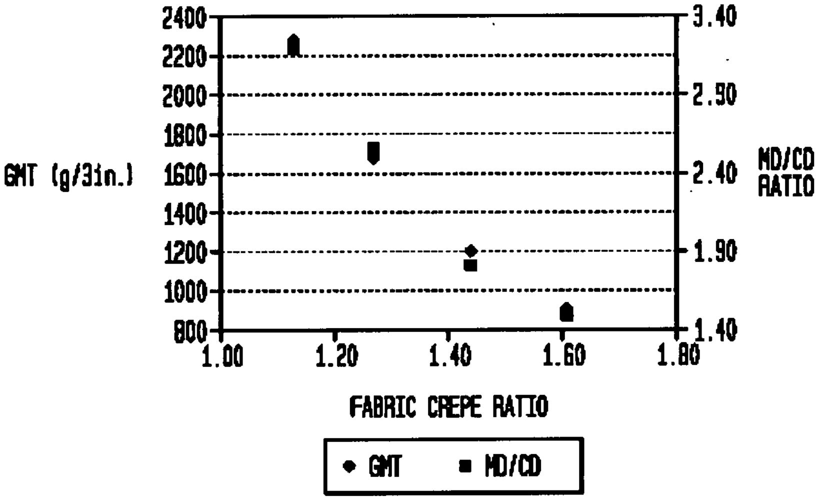
14. Before further discussing specific data in Table 5 of the *Grinnell et al.* '584 patent, contained in Cols. 19-22, I point out that it is not possible to be absolutely certain what specific values mean in that table since definitions are lacking. For example, I think that "Por. (100 sec)" refers to standard Gurley values, Elongation (Z) was meant to mean % stretch and so forth based on my experience in the

papermaking industry. I make the following specific comments based on how I believe one of skill in the art would interpret the information presented in Table 5 of United States Patent No. 5,314,584.

15. I have commented above on the likely water absorbency of products contemplated by the *Grinnell et al.* '584 patent based on bulk information in the text of the Patent (paragraph 10 above). Looking at Table 5 of the reference, Cols. 21-22, I see in the last rows reference to a size press roll. The 11th Column of the Table recites pressures (30 psig/30 psig), while the 12th Column recites % pick up with a range of 0.62 to 5.8. I believe this data indicates that, even under 30 psig pressure, the book cover would only absorb up to about 6% starch. These very low values would, in my opinion, indicate to one of skill in the art that the material is not as suitable as absorbent sheet.

16. In Table 5 of *Grinnell et al.* '584 (Cols. 19-22), there appears data on the book cover stock including "Por. (100 s)" which I think are Gurley porosity values of about 6 1/2 to 34 seconds. These values, as well as the other data in Table 5 of *Grinnell et al.* '584 are consistent with paperboard products (*see* paragraph 18 below for specific values). For example, the tensiles given are 15-20 lbs/in or 20,000 – 30,000 g/3". The absorbent products of the '862 Invention typically have tensiles 5-50 times lower than the values in Table 5 of *Grinnell et al.* '584. *See* **Figure 26**, reproduced below from the '862 application.

FIG. 26



Clearly, *Grinnell et al.* '584 is describing a much different product than absorbent sheet because ***it is*** paperboard.

17. The data of *Grinnell et al.* '584 in terms of specific basis weight, tensiles and porosity appears to correlate closely with the paperboard data appearing in United States Patent No. 6,846,529 to *Mohan et al.*, which is directed to paperboard for making paper cups and attached at Exhibit 3. It is seen in Table 2, Col. 10 of the '529 patent, that the paperboard of the *Moran et al.* '529 patent has specific basis weights in the 7-12 lbs/per mil per ream range only slightly higher than that of *Grinnell et al.* '584 (4-7 lbs/mil; *see* Col. 11, line 1 of *Grinnell et al.* '584). Basis weights in the *Moran et al.* '529 patent, Table 2, are 140-200 lbs/ream, somewhat higher than *Grinnell et al.* '584 which are much higher than tissue or towel:

Table 2, U.S. Patent No. 6,846,529

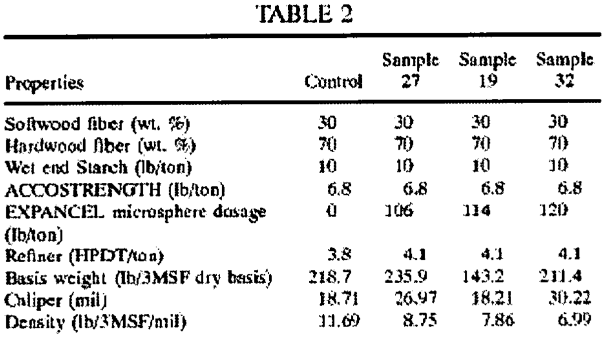


TABLE 2

Properties	Control	Sample 27	Sample 19	Sample 32
Softwood fiber (wt. %)	30	30	30	30
Hardwood fiber (wt. %)	70	70	70	70
Wet end Starch (lb/ton)	10	10	10	10
ACCOSTRENGTH (lb/ton)	6.8	6.8	6.8	6.8
EXPANCEL microsphere dosage (lb/ton)	0	106	114	120
Refiner (HPDT/ton)	3.8	4.1	4.1	4.1
Basis weight (lb/3MSF dry basis)	218.7	235.9	143.2	211.4
Caliper (mil)	18.71	26.97	18.21	30.22
Density (lb/3MSF/mil)	11.69	8.75	7.86	6.99

In Table 2, last line, Col. 11, of *Moran et al.* '529, Gurley values of 8-26 seconds are given, again consistent with the data of *Grinnell et al.* '584 and an order of magnitude less porous than absorbent sheet:

Table 2, U.S. Patent No. 6,846,529

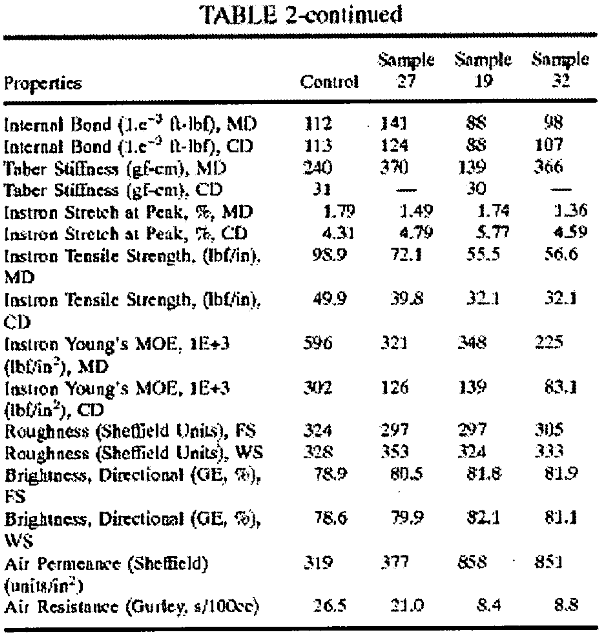


TABLE 2-continued

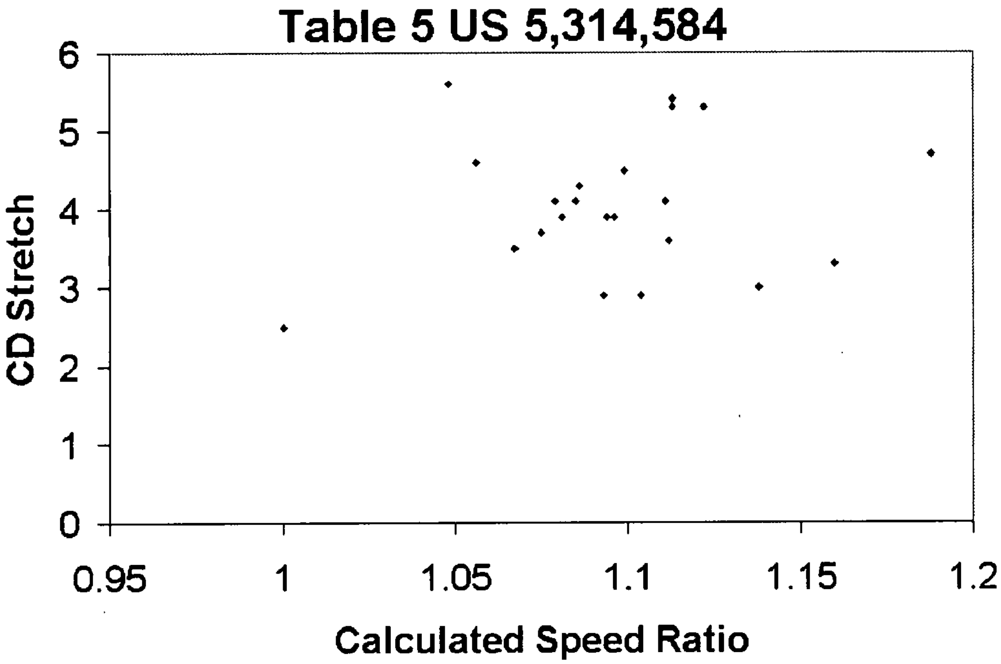
Properties	Control	Sample 27	Sample 19	Sample 32
Internal Bond ($1.e^{-3}$ ft-lbf), MD	112	141	88	98
Internal Bond ($1.e^{-3}$ ft-lbf), CD	113	124	88	107
Taber Stiffness (gf-cm), MD	240	370	139	366
Taber Stiffness (gf-cm), CD	31	—	30	—
Instron Stretch at Peak, %, MD	1.79	1.49	1.74	1.36
Instron Stretch at Peak, %, CD	4.31	4.79	5.77	4.59
Instron Tensile Strength, (lbf/in), MD	98.9	72.1	55.5	56.6
Instron Tensile Strength, (lbf/in), CD	49.9	39.8	32.1	32.1
Instron Young's MOE, 1E+3 (lbf/in^2), MD	596	321	348	225
Instron Young's MOE, 1E+3 (lbf/in^2), CD	302	126	139	83.1
Roughness (Sheffield Units), FS	324	297	297	305
Roughness (Sheffield Units), WS	328	353	324	333
Brightness, Directional (GE, %), FS	78.9	80.5	81.8	81.9
Brightness, Directional (GE, %), WS	78.6	79.9	82.1	81.1
Air Permeance (Sheffield) (units/in^2)	319	377	858	851
Air Resistance (Gurley, s/100cc)	26.5	21.0	8.4	8.8

It is thus clear to me that *Grinnell et al.* '584 does not disclose, teach or suggest the highly porous, absorbent structures of the '862 Invention. Table 5 of *Grinnell et al.* '584 is somewhat abbreviated; however I think it is worthwhile to calculate a fabric crepe ratio and to compare the data with the '862 Invention even though this includes various assumptions.

18. For purposes of comparing the data of Table 5 with the '862 Invention, I estimated the fabric crepe ratio by taking the MD stretch value in Table 5, subtracting the 1.2% MDStr found in Sample 6 (no fabric crepe) assuming that most of the grades would inherently have that MD Stretch or less, and then divided by 100 and added 1. Assuming "S" is the speed difference in feet per minute, I also calculated a reel speed, which appears to be consistent with the pilot line capability at the time in the facility where the development work underlying the *Grinnell et al.* patent was likely done. I also converted tensiles for purposes of comparison. Results appear in the following table and graph.

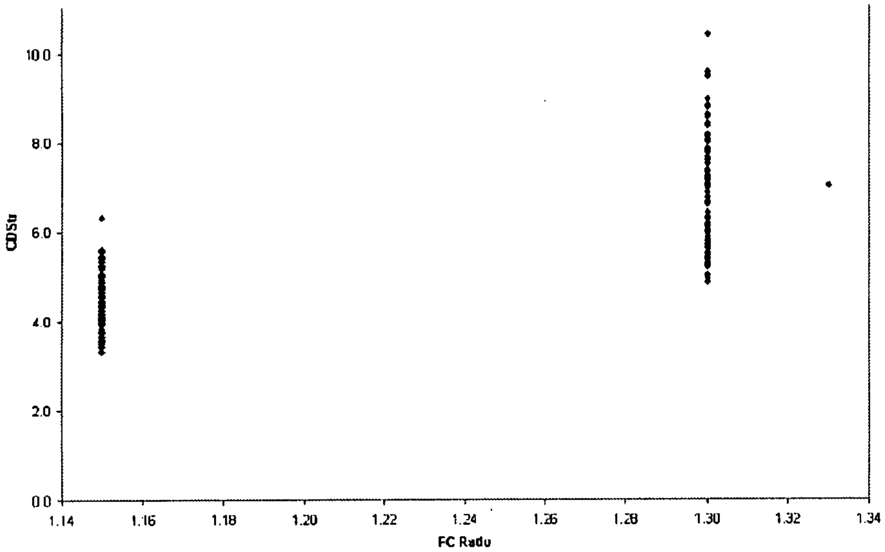
US Patent 5,314,584 Table 5 With Calculated Values of Crepe Ratio and Reel Speed

Sample	S	Bwt lbs/3000 ft2	Cal mils	Por secs/ 100cc	MD, lbs/ in	CD, lbs/ in	MDStr %	CDStr %	MD, gms/ 3in	CD, gms/ 3in	Calc'd Speed Ratio	Reel Speed Based upon delta speed fpm
2	28	69	11.6	7.6	22	15	10.5	2.9	29964	20430	1.093	301
3	28	74	12.2	9.2	19	16	15	3	25878	21792	1.138	203
6	0	65	7.7	34.2	37	18	1.2	2.5	50394	24516	1	
9	28	75	11.7	8.4	16	15	11.6	2.9	21792	20430	1.104	269
15	27	70	11.2	6.6	24	18	12.4	3.6	32688	24516	1.112	241
17	28	78	11.2	11.6	23	20	12.3	4.1	31326	27240	1.111	252
19	27	74	10.7	11.6	25	17	9.1	4.1	34050	23154	1.079	342
20	27	83	11.5	17.8	24	18	9.7	4.1	32688	24516	1.085	318
22	27	72	10.8	8.8	24	17	9.3	3.9	32688	23154	1.081	333
23	28	73	10.9	7.6	22	18	7.9	3.5	29964	24516	1.067	418
25	27	84	12.2	6.8	23	17	8.7	3.7	31326	23154	1.075	360
46	25	68	10.5	14.1	31	21	11.1	4.5	42222	28602	1.099	253
47	25	68	10.2	13	30	20	10.6	3.9	40860	27240	1.094	266
48	26	70	10.3	8.2	29	19	10.8	3.9	39498	25878	1.096	271
49	25	72	11.3	15.8	31	21	12.5	5.3	42222	28602	1.113	221
50	25	69	10.5	17.7	30	21	9.8	4.3	40860	28602	1.086	291
51	25	74	10.8	17.1	32	22	12.5	5.4	43584	29964	1.113	221
52	25	66	9.1	9.8	33	20	6.8	4.6	44946	27240	1.056	446
53	25	82	10.3	17.6	37	23	6	5.6	50394	31326	1.048	521
54	24	75	11.9	8.8	30	20	20	4.7	40860	27240	1.188	128
59		64	9.9	9.6	29	20	13.4	5.3	39498	27240	1.122	
60		75	11.9	6.6	29	19	17.2	3.3	39498	25878	1.16	



It is seen from the above Table and graph that there is apparently a very random relationship between CD stretch and fabric crepe ratio (speed ratio above) in the *Grinnell et al.* '584 process.

19. Taking data on sheets made in accordance with the '862 application and making a similar graph, the data correlates much differently and indicates a very distinct relationship between CD stretch and fabric crepe ratio:



CD Stretch vs. Fabric Crepe Ratio for '862 Invention

Based on the apparently very different relationship between CD stretch and fabric crepe seen with the '862 Invention, I am of the opinion that the process of the '862 Invention is very different from the process described *in Grinnell et al.* '584.

20. The Grinnell et al. '584 patent also teaches to run a coarse fabric with large CD strands (shutes) against the web as it is creped. Col. 6, lines 66-68. The patent describes the fabric as a dual layer fabric of 59 x 59 weave. I assume this means that since it's a double layer it's about equivalent to a 29x29 or 30x30 single layer weave. Also specified are the warp and weft diameters: 0.025 in x 0.027 in shute (weft). Converting to mm, we get 0.64 mm x 0.69 mm. We've run fabrics this coarse with the long CD strands to the sheet. This is like running mini creping blades which fold up the sheet and make it stiff like corrugated roofing. We got huge bulks, but it was a very stiff sheet along the CD. The fabric ran very well but couldn't come close to producing the absorbent sheet we were interested in, even in towels which can be somewhat stiffer than tissue. Thus, based on the fabric used by *Grinnell et al.* '584 and the manner of using it, as well as the other data in the patent, I do not believe the '584 patent contemplates the manufacture of absorbent sheet, nor would one of skill in the art look to this reference for guidance as to making absorbent sheet suitable for tissue or towel.

21. Before returning to a discussion of the '862 Invention, I also believe the comments and description in the '584 patent are consistent with conventional creping. Consider Col. 7, lines 41-52:

> Also, because web **24** on smooth-surfaced roll **40** is moving faster than fabric **55**, web **24** slows down when it reaches the constricted area between smooth-surfaced roll **40** and fabric **55** in such a manner that the portion of web **24** in this constricted area is pushed from behind by the faster moving portion of web **24**, causing some of the slower moving portion of web **24** to be forced into open voids of fabric **55**, which in turn causes fabric **55** to hold web **24** and creates an undulated or embossed surface on web **24** when web **24** is subsequently separated form fabric **55**.

as well as Col. 10, lines 33-43:

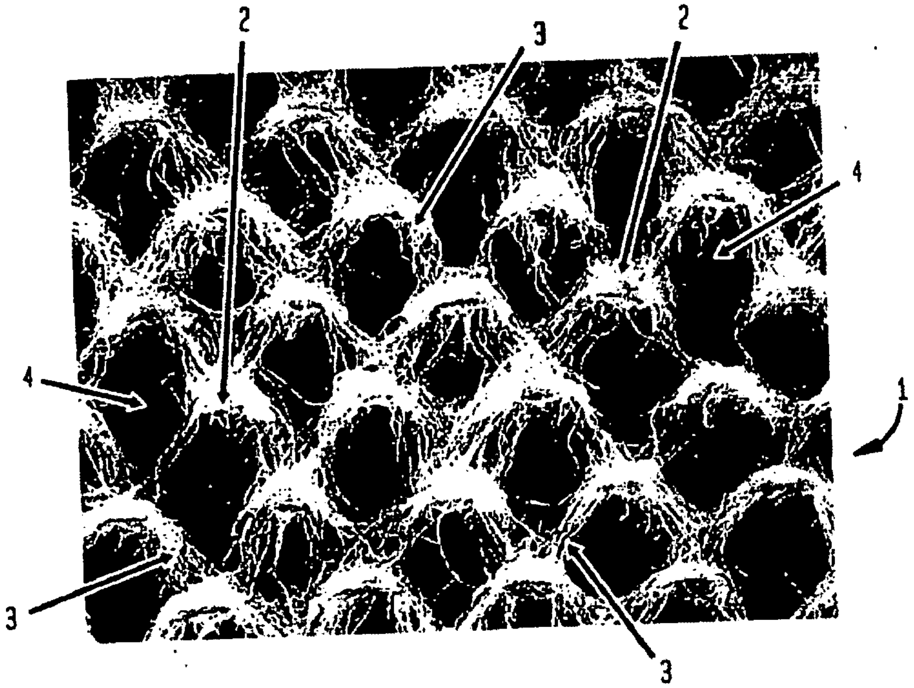
> As embodied herein, the greater speed of surface **44** of smooth-surfaced roll **40** as compared to the speed of fabric **55** causes tension in fabric **55** entering nip **80** to be greater than tension in fabric **55** leaving nip **80**. Depending on the elasticity of the fabric, the length of the voids **63** in fabric **55** are shortened in the machine direction as fabric **55** passes through nip **80**. This shortening has a "pinching" effect on the web which may contribute to the texturizing of the web surface. The pinching effect also helps fabric **55** to hold onto web **24** after exiting nip **80**.

In my view, the discussion on fabric creping does not suggest redistribution of fiber, nor local basis weight variation.

22. As noted earlier, the '862 Invention is directed, in part, to a wet-press process for making absorbent sheet including compactively dewatering, that is, wet-presssing a nascent web and subsequently belt or fabric-creping a wet web from a transfer surface such that the wet web is re-distributed on the creping belt. Re-orientation of the fiber occurs because of the consistency of the web, pressure and/or speed of the web when it is belt-creped, make it possible to achieve the unique structure and properties described in the '862 application. Referring to the application as filed, it is seen that the process of the '862 Invention is used to redistribute papermaking fibers to provide unique structural features, demonstrated in **Figure 1**. **Figure 1**, reproduced below, is a photomicrograph of a very low basis weight,

open mesh web **1** having a plurality of relatively high basis weight pileated regions **2** interconnected by a plurality of lower basis weight linking regions **3**. The cellulosic fibers of linking regions **3** have orientation which is biased along the direction as to which they extend between pileated regions **2**. The orientation and variation in local basis weight is surprising in view of the fact that the nascent web has an apparently random fiber orientation when formed and is transferred largely undisturbed to a transfer surface prior to being wet-creped therefrom. The imparted ordered structure is readily observed at extremely low basis weights where web **1** has open portions **4**.

FIG. 1



23. At higher basis weights, basis weight variation is not readily observed visually, even microscopically, because it is difficult to differentiate dense regions from less dense regions of the same basis weight. Using a beta-particle technique, measurements were taken on absorbent sheet of variable basis weight to demonstrate the basis weight difference between interconnected low basis weight regions and high basis weight regions. The sheet was similar to that described in United States Patent Application Serial No. 10/679,862 in terms of structure and properties and was produced by the process claimed in the '862 application, but

had a different pattern. Details appear in co-pending United States Provisional Application No. 60/808,863, filed May 26, 2006, entitled "Fabric Creped Absorbent Sheet with Variable Local Basis Weight" (Attorney Docket No. 20179; GP-06-11), **Figure 26** and Table 2 of which, along with the associated text, are reproduced below.

FIG. 26

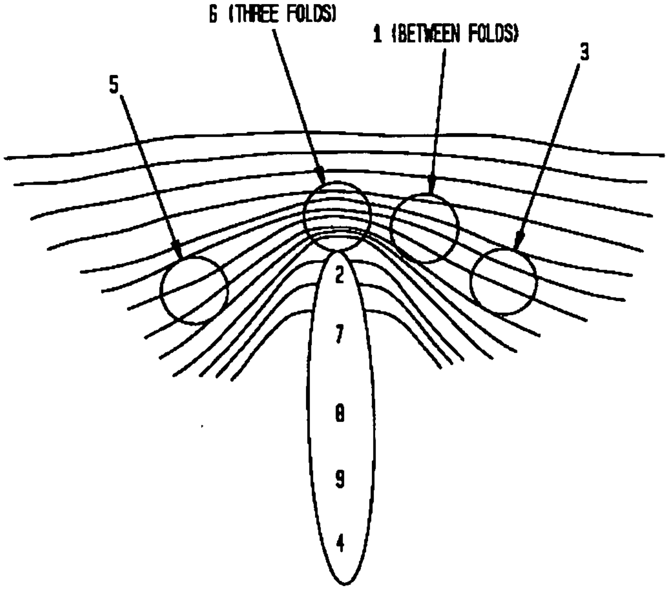


Table 2

Position	Count	Calculated Basis Weight
1	60	32.38424
2	73.8	25.24474
3	76.6	23.96046
4	71.2	26.48168
5	66.3	28.94078
6	37.5	**48.59373**
7	55.8	34.88706
8	60.4	32.15509
9	59.9	32.44177

It is appreciated from the foregoing that the local basis weight at position **6** (fiber-enriched region) is much higher, by 50% or so than position **2**, a low basis weight region. The basis weight variation observed is surprising, especially in view of conventional wisdom which suggests introducing basis weight variation during web formation, summarized in paragraph 24, below.

24. Conventional web processing techniques such as rush transfers, dry creping, wet creping and so forth do not introduce substantial variations in basis weight in absorbent products. In this regard, I *note* United States Patent No. 6,136,146 of *Phan et al.*, Col. 4, lines 8-42 where area-selective draining during forming is used to create basis weight variation in absorbent sheet:

> The present invention also provides a method of producing a non-through air dried paper web having at least two regions of different basis weight and at least two regions of different density. The method includes the steps of: providing a plurality of fibers suspended in a liquid carrier; providing a fiber retentive forming element having liquid pervious zones; depositing the fibers and the liquid carrier onto the forming element; draining the liquid carrier through the forming element in at least two simultaneous stages to form a web having at least two regions of different basis weight; providing a web support apparatus comprising a web patterning surface and a dewatering felt layer; transferring the web from the forming element to the web patterning surface of the web support apparatus; selectively densifying a portion of the web to provide the web with at least two different densities; and drying the web.
>
> The step of selectively densifying a portion of the web comprises providing a continuous network, relatively high density region and a plurality of discrete, relatively low density regions dispersed throughout the continuous network, relatively high density region. The step of draining the liquid carrier through the forming element can include forming a web having a relatively high basis weight, continuous network and a plurality of discrete, relatively low basis weight regions dispersed throughout the relatively high basis weight continuous network. In one embodiment, the step of draining the liquid carrier through the forming element comprises forming a web having a relatively high basis weight, continuous network region; a plurality of discrete, relatively low basis weight regions dispersed throughout the relatively high basis weight, continuous network region, and a plurality of discrete, intermediate basis weight regions circumscribed by the relatively low basis weight regions.

It is seen from the foregoing that a relatively complex and difficult formation technique is required to achieve basis weight variation. Similar techniques to introduce basis weight variation in a web forming step are seen in United States Patent Nos. 5,503,715 and 5,935,381 to *Trokhan et al.*, discussed in the '862 application as filed, on page 3. In contrast, the '862 Invention achieves basis weight variation with pressure in a fabric creping nip and/or a high speed transfer while controlling moisture, nip parameters and so forth; an unexpected result which provides superior softness and absorbency to wet-press products.

25. Some salient features of the '862 Invention are summarized in Table 6 of the application as filed, page 66, reproduced below:

Table 6 – Comparison of Typical Web Properties

Property	Conventional Wet Press	Conventional Throughdried	High Speed Fabric Crepe
SAT g/g	4	10	6-9
*Bulk	40	120+	50-115
MD/CD Tensile	>1	>1	<1
CD Stretch (%)	3-4	7-10	5-10

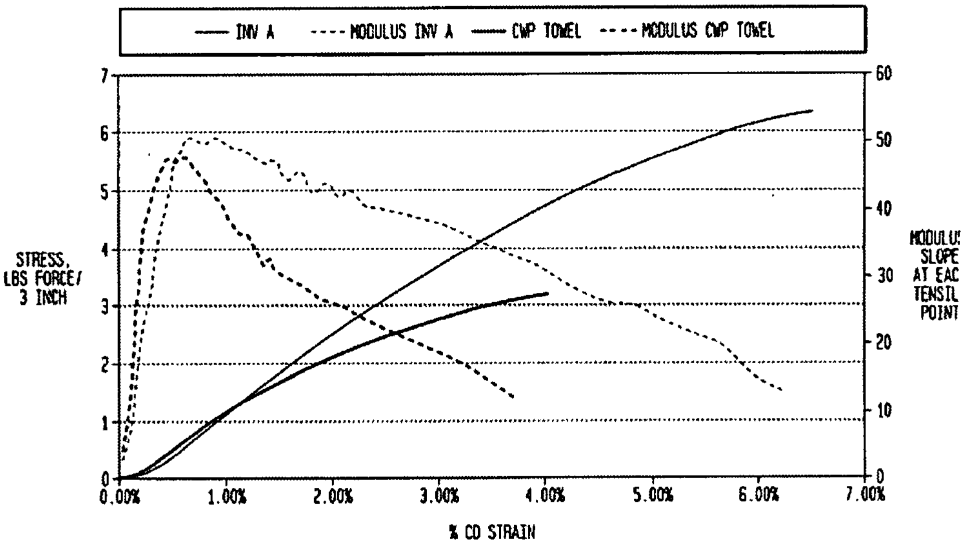
*mils/8 sheet

26. A highly desirable and unexpected result achieved with the '862 Invention is the ability to produce products with relatively low MD/CD dry tensile ratios under a variety of conditions. This feature is desirable since CD strength is a limiting manufacturing consideration, often forcing much higher GM tensiles than necessary if the MD/CD tensile ratio was lower. MD/CD tensile ratios of less than about 1.1 are generally unexpected in a compactively dewatered product and make it possible to use less fiber in some products and to make other products softer.

27. Still yet another unexpected and superior feature observed with the Present Invention is the relatively high CD stretch values seen in **Figure 42** of United States Patent Application Serial No. 10/679,862, for example, wherein the CD

stretch is more than about 4% for a compactively dewatered product that is fabric-creped in accordance with the '862 Invention.

FIG. 42

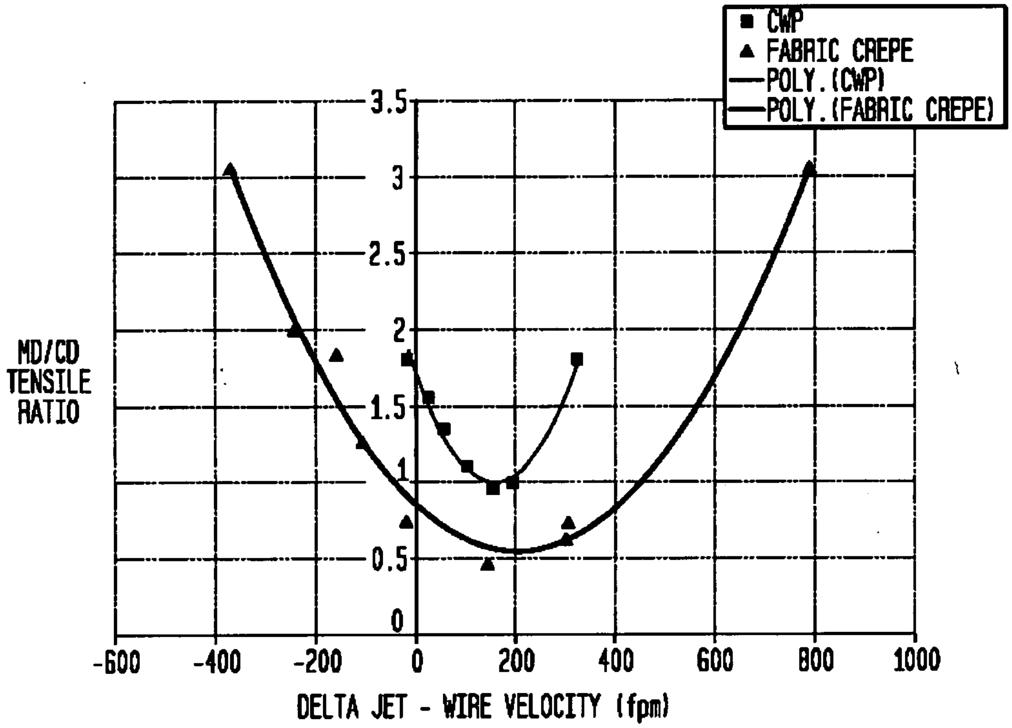


CD stretch of tissue and towel is very important to perceived toughness of an absorbent product since it is a measure of elongation at rupture of the product in the cross-machine direction, where stretch is typically lowest for CWP and creped products. CD stretch values of about 5%-10% are particularly unexpected since such CD stretch values were conventionally seen only in throughdried absorbent sheet.

28. With the '862 invention we are able to achieve an improved absorbent sheet by re-distribution and/or re-orienting fiber on a creping fabric or belt to attain the desired properties. One of skill in the art, I for one, would think this would eliminate or at least greatly reduce the influence the web forming conditions such as jet/wire ratio and so forth. It is seen in **Figure 39** of United States Patent Application Serial No. 11/108,375 filed April 18, 2005 (Attorney Docket No. 12389P1, continuation in part to this '862 application) that jet/wire ratios can be used to control tensile ratios, notwithstanding re-distribution of the fiber formation. **Figure 39** is a plot of MD/CD tensile ratio (strength at break) versus the difference between headbox jet velocity and forming wire speed (fpm). The

upper U-shaped curve is typical of conventional wet-press absorbent sheet. The lower, broader, curve is typical of fabric-creped product of the invention. It is readily appreciated from **Figure 39** that MD/CD tensile ratios of below 1.5 or so are achieved in accordance with the invention over a wide range of jet to wire velocity deltas, a range which is more than twice that of the CWP curve shown. Thus control of the headbox jet/ forming wire velocity delta may be used to achieve desired sheet properties.

FIG. 39



It is also seen from **Figure 39** that MD/CD ratios below square (i.e. below 1) are difficult; if not impossible to obtain with conventional wet-press processing.

In many products, the cross machine properties are more important than the MD properties, particularly in commercial toweling where CD wet strength is critical. A major source of product failure is "tabbing" or tearing off only a piece of towel rather than the entirety of the intended sheet. In accordance with the invention, CD tensiles may be selectively elevated by control of the headbox to forming wire velocity delta and fabric creping. I find this especially surprising in view of the fact that the fiber in the web has been re-distributed after formation.

29. I also declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the subject application or any patent issuing thereon.

Dated April 3, 2007

Steven L. Edwards

Steven L. Edwards